DOCUMENT RESUME

ED 263 419 CE 042 967

TITLE Math on the Job. Motor-Vehicle Mechanic.
INSTITUTION Ohio State Univ., Columbus. National Center for Research in Vocational Education.
SPONS AGENCY Office of Special Education and Rehabilitative Services (ED), Washington, DC.
PUB DATE 85
GRANT G008300003
NOTE 27p.; For the other booklets in this series, see CE 042 963-994.
PUB TYPE Guides - Classroom Use - Materials (For Learner) (051)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Auto Mechanics; *Career Awareness; Career Education; *Disabilities; Emotional Disturbances; Enrichment Activities; Equipment Utilization; Learning Disabilities; *Mathematics Skills; Measurement Equipment; Measurement Techniques; Mental Retardation; *Motor Vehicles; Occupational Information; Secondary Education; Skill Development; Special Education; *Work Environment

ABSTRACT

This booklet is intended to help mainstreamed mentally retarded, emotionally disturbed, or learning disabled high school students acquire a basic understanding of the responsibilities and working conditions of motor vehicle mechanics and to practice basic math skills necessary in the occupation. The first section provides a brief introduction to the occupation by focusing upon those job tasks of a motor vehicle mechanic with which the student is likely to be familiar. The next two sections deal with the work environment of the typical motor vehicle mechanic and the training, education, and experience needed for the occupation. Exercises addressing basic math skills used by motor vehicle mechanics are provided. Various suggestions are listed for students interested in further exploring the occupation of motor vehicle mechanic. A glossary and answer sheet conclude the booklet. (MN)

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MATH on the job

Motor-Vehicle Mechanic

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MATH ON THE JOB:

MOTOR VEHICLE MECHANIC

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MATH on the job

Motor-Vehicle Mechanic

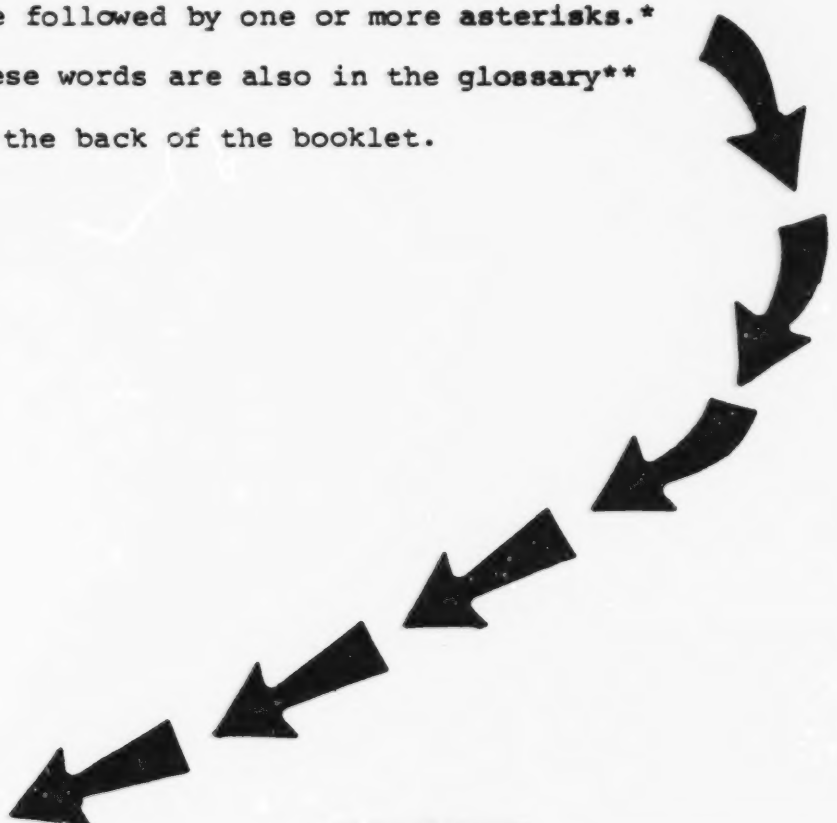
In this booklet, you can--

- find out what a motor vehicle mechanic does
- see how a motor vehicle mechanic uses math
- get a chance to use math as a motor vehicle mechanic
- find out the types of things a motor vehicle mechanic needs to know
- find out what courses, training, and experience you need to become a motor vehicle mechanic

SPECIAL WORDS USED IN THIS BOOKLET

Workers in many jobs use special words or special meanings for words. Learning these words helps you to learn about a job.

You will find some of these special words in this booklet. When these words, and some hard words, are used for the first time, they are followed by one or more **asterisks.*** These words are also in the **glossary**** at the back of the booklet.



DEFINITIONS

*An <u>asterisk</u> (*) is a symbol that tells you to look at the bottom of the page for the meaning, or definition, of the word.

**A <u>glossary</u> is a list of words with their meanings.

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HAVE YOU EVER...

- checked the oil in a car or truck?
- taken a car or truck to the shop for repair?
- watched someone fix a car or truck?
- done any repair work on a car or truck?

If you have, then you have some idea about the work of a motor vehicle mechanic. This booklet will help you learn about the work of a motor vehicle mechanic and how math is important to do the job.

WHAT DOES A MOTOR VEHICLE MECHANIC DO?

A motor vehicle mechanic services gasoline- or diesel-powered vehicles such as automobiles, buses, and trucks. As a mechanic, you will maintain and repair vehicles. To maintain vehicles, you will--

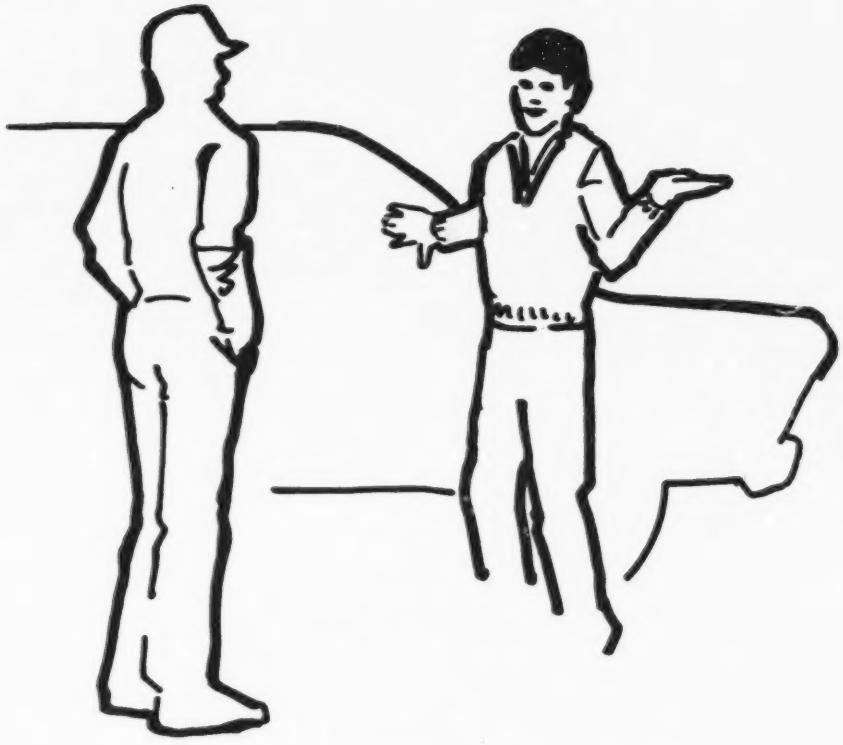
- use testing equipment such as spark plug testers and engine analyzers to check parts
- replace or repair worn parts to prevent the vehicle from breaking down
- give vehicles regular tune-ups* to keep them in good running order
- use technical manuals to plan work procedures

DEFINITION

*A tune-up is the checking and adjusting of motor parts.

To repair vehicles, you will--

- talk with the owner of the vehicle to get a description of the problem
- test drive the vehicle
- use testing equipment such as spark plug testers and engine analyzers to find broken parts
- repair or replace broken parts



As a motor vehicle mechanic, you will use math in your work every day. You will--

- count, add, subtract, multiply, and divide
- use whole numbers, fractions, and decimals
- estimate* the cost of materials and labor to complete a job
- prepare customers' bills for parts and service
- take measurements and read gauges

DEFINITION

*To **estimate** is to carefully guess the number or amount of something.

A motor vehicle mechanic uses math to take measurements.

EXAMPLE

Many measurements that a motor vehicle mechanic makes are in metric units. The mechanic must know the correct metric unit to use when making a measurement.

The table below lists the metric terms that are commonly used.

Quantity	Unit	Symbol	Use
Length	millimeter	mm	shaft size, length
	centimeter	cm	bearing sizes
Area	square cm	cm^2	piston head surface
Volume/ capacity	cubic cm	cm^3	cylinder bore
	milliliter	ml	chemicals, lubricant
	liter	l	oil, fuel, gasoline storage
Mass	gram	g	tire weights
	kilogram	kg	battery engines
	metric ton	t	vehicles, load weights

What measurement would you use to measure the length of a fuel line? You're right if you said millimeter.

NOW YOU TRY IT

Practice Exercise A

Which unit of measurement would you use in the following situations:

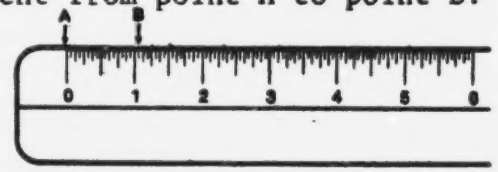
1. Volume of a fuel tank?
2. Length of a fan belt?
3. Amount of water in a radiator?
4. Diameter of a camshaft?
5. Bore of a cylinder?
6. Length of an exhaust pipe?

A motor vehicle mechanic uses math to measure parts.

EXAMPLE

A motor vehicle mechanic often uses a ruler to measure a part, such as a bolt or flat washer.

A picture of a ruler is shown below. What is the measurement from point A to point B?



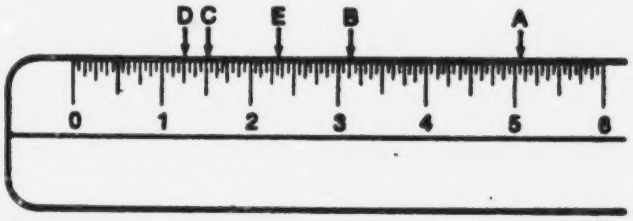
To read a ruler, you must be familiar with the marks, or graduations, on the ruler. On the ruler above, each inch is divided into 16 equal parts. The distance between two consecutive marks is 1/16 inch.

The distance between point A and point B is 1-1/16.

NOW YOU TRY IT

Practice Exercise B

What is the measurement for each lettered point on the ruler below?

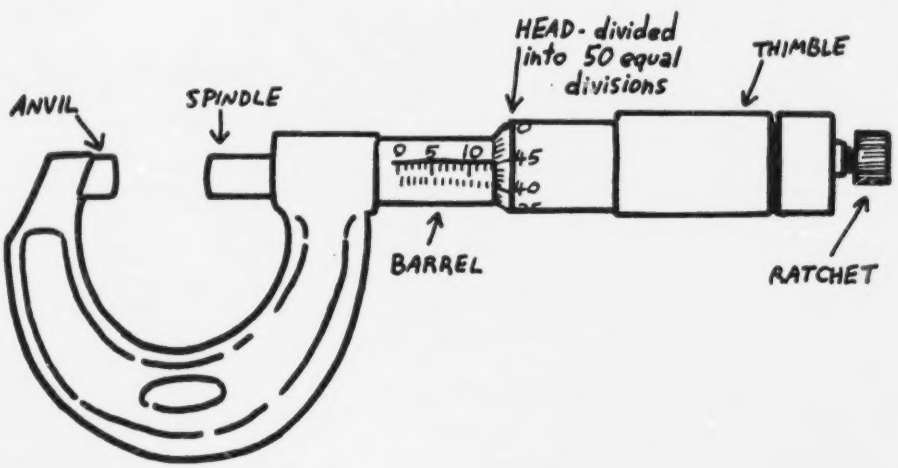


	Point	Measurement
7.	A	?
8.	B	?
9.	C	?
10.	D	?
11.	E	?

A motor vehicle mechanic uses math to read measuring instruments.

EXAMPLE

A motor vehicle mechanic uses special measuring instruments, such as micrometers. A metric micrometer measures items to the nearest hundredth of a millimeter. The basic parts of a micrometer are labeled in the figure below.



To measure a small object, place it between the anvil and the spindle. Turn the thimble until the object fits snugly.

The micrometer has markings for whole millimeters (the upper set of marks on the barrel). The lower set of marks on the barrel are for half millimeters. The marks on the head indicate .01 millimeters.

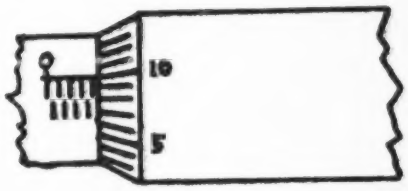
To read a metric micrometer, you--

Step 1. Find the whole millimeters in the measurement by counting the number of upper marks on the barrel that are to the left of the head.

Step 2. Find the decimal part of the measurement by reading the markings on the head. Read the marking that is most nearly in line with the center line on the barrel. Multiply this reading by .01. If the head is on, or immediately to the right of a half millimeter marking, add .50 to the reading on the head.

Step 3. To get the total reading, add the numbers from Step 1 and Step 2.

What is the measurement on the metric micrometer below?



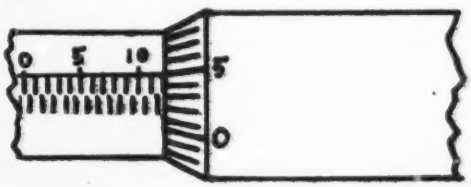
Barrel reading	4.00
Head reading	.10
	+ .50
Total measurement	4.60

NOW YOU TRY IT

Practice Exercise C

What is the measurement on each metric micrometer below?

12.



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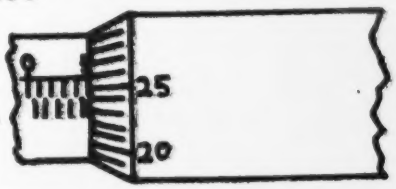

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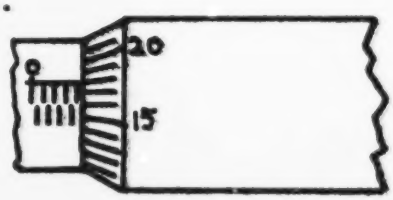

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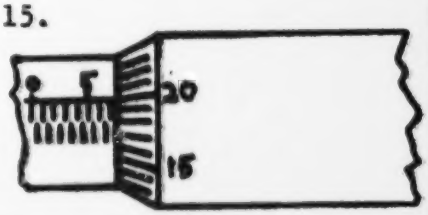


A motor vehicle mechanic uses math to prepare customers' bills.

EXAMPLE

Assume that you are a mechanic in a small service station. You are to charge $16.75 an hour for labor. How much do you charge a customer for labor if you spend 2 hours repairing a radiator?

To calculate the labor charges, multiply the rate for each hour by the number of hours. For this example, your calculation should look like this:

$16.75 x 2 = $33.50

You would charge the customer $33.50 for labor.

NOW YOU TRY IT

Practice Exercise D

How much labor should you charge each customer?

	Rate for Each Hour	Number of Hours	Labor Charge
16.	$15.00	3	?
17.	$22.50	4	?
18.	$14.75	6	?
19.	$18.50	4-1/2	?
20.	$19.75	5-1/2	?

WHERE DOES A MOTOR VEHICLE MECHANIC WORK?

As a motor vehicle mechanic, you will work in a repair shop or garage. Repair shops are noisy and dangerous. Serious accidents can be avoided by--

- keeping your work space clean
- following the shop safety rules

As a motor vehicle mechanic, you will work with other mechanics in a repair shop or garage. You will have a shop supervisor who tells you what to do. You will also work with customers. You will ask the customers questions about their cars. You will tell the customers what work must be done and estimate the cost.

Motor vehicle mechanics use special types of equipment to perform their work. As a mechanic, you use--

- simple hand tools like screwdrivers and wrenches
- complicated and expensive equipment like spark plug testers and engine analyzers

Because the automobile is a complex machine, there are many mechanics who specialize in the repair or service of specific parts. Some of these mechanics are the--

- tune-up mechanic whose chief job is to locate defects and to replace or repair worn parts.
- automatic transmission mechanic who adjusts, repairs, and maintains the transmission* system.
- electrical repair mechanic who adjusts, repairs, and installs parts of the electrical or ignition system.
- body and fender repair person who removes dents in the car body and replaces any sections of the body which need new sheet metal, glass, or trim.

DEFINITION

*A transmission is the system of gears and other parts of an automobile which moves the power from the engine to the axles and wheels.

IF YOU ARE INTERESTED IN

THE WORK OF A MOTOR VEHICLE MECHANIC

AND WOULD LIKE TO KNOW MORE,

READ ON

WHAT TRAINING, EDUCATION, AND EXPERIENCE DO YOU NEED TO BECOME A MOTOR VEHICLE MECHANIC?

What do you think? Would you like to be a motor vehicle mechanic? If you would, there are some things you should know.

To get a job as a motor vehicle mechanic, you need to know how--

- to use specialized hand tools
- motor vehicles are constructed
- motor vehicles operate

The best way to learn these things is to take courses in science, mathematics, and shop at your high school, vocational education center, or community college.

To be a motor vehicle mechanic, you should be a high school graduate. After high school, you must enter either an apprenticeship program or an on-the-job training program.

An apprenticeship program combines work experience with classroom instruction. Apprenticeship programs may take up to four years, and you are paid for the work you do.

In an on-the-job training program, you will help experienced mechanics do their work. They will show you what to do and train you on the job. You may start as a helper, car washer, or gasoline attendant and work your way up to mechanic. On-the-job training programs may take up to five years, and you are paid for the work you do.

Taking every chance to learn new skills and tasks will help you do a better job. Good math skills will also help you perform your work as a motor vehicle mechanic.

DO YOU WANT TO DO MORE MOTOR VEHICLE MECHANIC'S MATH?

Practice Exercise E

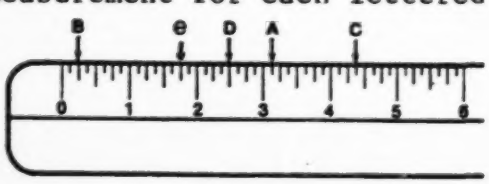
Use the following table to determine which unit of measurement should be used in each situation.

Quantity	Unit	Symbol	Use
Length	millimeter	mm	shaft size, length
	centimeter	cm	bearing sizes
Area	square cm	cm^2	piston head surface
Volume/ capacity	cubic cm	cm^3	cylinder bore
	milliliter	ml	chemicals, lubricant
	liter	l	oil, fuel, gasoline storage
Mass	gram	g	tire weights
	kilogram	kg	battery engines
	metric ton	t	vehicles, load weights

21. Mass of small engine
22. Capacity of a radiator
23. Volume of oil for crank case
24. Weight of a tire
25. Length of a battery cable
26. Diameter of a piston head

Practice Exercise F

What is the measurement for each lettered point on the ruler below?



	Point	Measurement
27.	A	?
28.	B	?
29.	C	?
30.	D	?
31.	E	?

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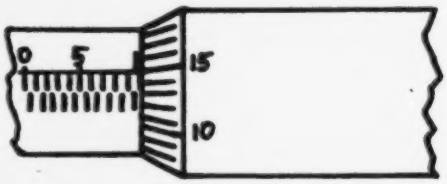
Practice Exercise G

What is the reading on each metric micrometer?

32.



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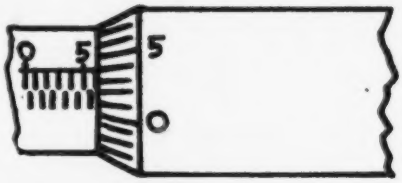

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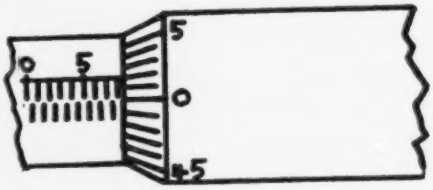

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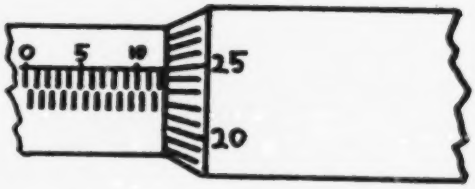

Practice Exercise H

How much is the labor charge for each customer?

	Rate for Each Hour	Number of Hours	Labor Charge
36.	$12.00	3	?
37.	$18.50	4	?
38.	$22.25	4 1/2	?
39.	$18.25	5 1/2	?
40.	$15.25	7 1/2	?

DO YOU WANT TO EXPLORE SOME MORE?

1. Visit your school library. Ask the librarian if the library has any material that would give you more information about motor vehicle mechanics and the work they do.

2. Check to see if your school offers vocational training in automotive repair. If such training is offered, contact the instructor and arrange to visit the class. Find out the types of classes students are taking, the machines and tools they work with, and why they are taking auto repair courses.

3. Visit different automotive repair shops. How are the smaller ones different from the larger ones? Watch the mechanics work for a few minutes at each shop. What things do you like and dislike about the job?

4. Are you interested in other jobs which are similar to that of the motor vehicle mechanic?

   - Automotive body repair persons fix or replace dented parts of a vehicle.
   - Automotive body painters paint old or repaired vehicles.
   - Service station attendants perform such services as pumping gas, checking oil, cleaning windows, and accepting payment.
   - Repair service estimators figure out what repairs are needed, how much the repairs will cost, and how long repairs will take.
   - Stock clerks in an automotive parts store unpack, show, and get equipment, materials, and supplies for customers.

   You must have good math skills to do these jobs well. Most of these workers add, subtract, multiply, and divide every day on the job.

GLOSSARY

Asterisk (*): a mark that tells you to look at the bottom of the page for the meaning, or definition, of the word.

Estimate: to carefully guess the number or amount of something.

Glossary: a list of words with their meanings.

Transmission: the system of gears and other parts of an automobile which moves the power from the engine to the axles and wheels.

Tune-up: the checking and adjusting of motor parts.

ANSWER SHEET

Practice Exercise A

1. liter
2. millimeter
3. liter
4. millimeter
5. cubic centimeter
6. millimeter

Practice Exercise B

7. 5-1/16"
8. 3-1/8"
9. 1-1/2"
10. 1-1/4"
11. 2-5/16"

Practice Exercise C

12. 12.05 millimeters
13. 5.26 millimeters
14. 4.68 millimeters
15. 7.70 millimeters

Practice Exercise D

16. $45.00
17. $90.00
18. $88.50
19. $83.25
20. $108.63

Practice Exercise E

21. kilogram
22. liter
23. milliliter
24. gram
25. millimeter
26. square centimeter

Practice Exercise F

27. 3-1/8"
28. 1/4"
29. 4-3/8"
30. 2-1/2"
31. 1-3/4"

Practice Exercise G

32. 10.15 millimeters
33. 6.04 millimeters
34. 8.52 millimeters
35. 12.75 millimeters

Practice Exercise H

36. $36.00
37. $74.00
38. $100.13
39. $100.38
40. $114.38